Chapter

Alternative Natural Management of Dyslipidemia

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Abstract

In hypercholesterolemic patients, besides therapeutic treatments, alternative treatments can be used such as lifestyle changes, e.g. avoiding smoking, regular exercise, and consuming a diet rich in fiber and low in trans saturated and saturated fats. There are also certain plant products, such as the gum residue guggulipid, that are used in India as a traditional medicine to reduce blood cholesterol levels. Similarly, red yeast rice and rice bran oil have been observed to reduce elevated cholesterol levels. Other herbal products have also been investigated for their role in lowering cholesterol levels, as well as various other herbs and spices such as ginger and turmeric. Another herbal remedy available for reducing high cholesterol levels is the leaf extract of *Cynara scolymus*, commonly known as artichoke thistle. *Cynara cardunculus* var. *scolymus*, or globe artichoke, is mainly cultivated as a food crop. It has an important effect on reducing plasma cholesterol and low-density lipoprotein levels.

Keywords: alternative medicine, lifestyle changes, natural plants, Chinese medicine, vitamins and minerals

1. Dyslipidemia and Lifestyle

Hypercholesterolemia (HC) is defined as the increase in the levels of cholesterol in the blood. As per the recommendation of the expert panel of the National Cholesterol Education Program, desirable blood cholesterol levels should be <200 mg/dL. Levels ranging between 200 and 239 mg/dL are considered as borderline for cholesterol levels, and individuals with blood cholesterol levels above 240 mg/dL are considered hypercholesterolemic [1]. HC occurs due to both environmental and genetic factors [2]. According to familial HC, environmental factors mainly include obesity and diets rich in saturated fats, whereas genetic factors comprise the additive effects of several genes or defects in a single gene [3–5]. Elevated cholesterol levels in the blood not only cause coronary heart disease but can also lead to stroke and damage to the brain [6, 7]. High cholesterol has also been linked to peripheral vascular disease, in which fat is deposited mainly in the arteries that lead to the legs and feet [8]. HC is also linked to type 2 diabetes and hypertension [9, 10].

In hypercholesterolemic patients, besides therapeutic treatments, alternative treatments can be used such as lifestyle changes, e.g. avoiding smoking, regular exercise, and consuming a diet high in fiber and low in trans saturated and saturated fats. Similarly, red yeast rice and rice bran oil have been observed to reduce elevated cholesterol levels. Other herbal products have also been investigated for their role in lowering cholesterol levels, as well as various other herbs and spices such as ginger and turmeric.

Another herbal remedy is the leaf extract of *Cynara scolymus*, commonly known as artichoke thistle. *Cynara cardunculus* var. *scolymus*, or globe artichoke, is mainly cultivated as a food crop. It has important effects in reducing plasma cholesterol and low-density lipoprotein (LDL) levels. Also, many vitamins and minerals help to reduce and control fat and cholesterol levels.

These will be discussed in this chapter.

1.1 Lifestyle changes

One of the most important things in the natural treatments of dyslipidemia is to reduce body weight and take regular exercise [11], which will help to regulate blood cholesterol [12] and decrease the high risk of developing cardiovascular diseases, especially coronary heart disease [13].

1.2 Stopping smoking

This is important in controlling high blood cholesterol, decreasing the risk of coronary heart disease, and improving high-density lipoprotein (HDL) cholesterol [14]. The mechanism of cigarette smoking will have an effect on lipid profile and enhance oxidation of plasma LDL, which leads to endothelial function impairment.

1.3 Alcohol intake

Alcohol has adverse effects on cholesterol and lipid levels, including raising serum triglyceride and HDL cholesterol levels. It has a minimum effect on LDL cholesterol but has effects on the body, including hepatic toxicity, cardiomyopathy, impaired reflexes, and psychosocial problems [15].

1.4 Exercise

Exercise is important in reducing the chance of developing heart disease. It is also important to reduce body weight, which can lead to reduced levels of fat and cholesterol [11].

Physical activity and exercise can be an important factor to improve cholesterol levels, increase HDL, and reduce LDL and triglycerides [16].

Aerobic exercise can generally improve lipid profile [17].

Moderate intensity aerobic exercise and an increase in physical activity in healthy people for more than 30 minutes for 5 days a week are important to maintain low LDL, cholesterol, and triglyceride levels, as well as increase HDL levels [18, 19].

In dyslipidemia especially in older or disabled individuals, increasing physical activity for more than 30 minutes for 5 days a week, moderate-intensity aerobic exercise [19], and high-intensity resistance exercises can all reduce LDL and triglycerides and increase HDL [20].

The beneficial effects of regular physical activity and exercise on cholesterol levels are important in the management of dyslipidemia and can lead to reducing the risks of heart attacks, strokes, and coronary heart disease.

2. Food that should be avoided

1. Food containing too much sugar and carbohydrates, which stimulate the liver to produce more cholesterol, should be avoided.

2. Hydrogenated and trans fats increase cholesterol and the risk of cardiovascular diseases.

3. Red meat and animal products increase the risk of dyslipidemia.

3. Food and dyslipidemia

Foods that help to decrease dyslipidemia are shown in **Tables 1** and **2**.

3.1 Dietary fiber intake

Dietary fiber (DF) intake provides many health benefits. However, the average fiber intake for US children and adults is less than half of the recommended levels. Individuals with high intakes of DF appear to be at significantly lower risk for developing coronary heart disease, stroke, hypertension, diabetes, obesity, and certain gastrointestinal diseases. Increasing fiber intake lowers blood pressure and serum cholesterol levels.

The effect of dietary soluble fiber on serum cholesterol levels has been extensively documented and promoted. The main mechanisms for the cholesterol-lowering effects of water-soluble and -insoluble DFs include binding and excretion of bile acids (BAs) in the small intestine. The cholesterol-reducing effect of water-insoluble DF, such as lignin or citric fiber, is rather low compared to water-soluble DF and is mainly based on direct binding of BAs. In the small intestine the BAs are bound to the insoluble DF and excreted from the enterohepatic circulation together with the undigested DF, which results in a lowering of blood cholesterol levels.

In addition, soluble fibers are known to bind to BAs in the small intestine, thereby removing them from the body and reducing the rate of BA recycling. The loss of BAs in the stool stimulates the liver to increase cholesterol uptake from the circulation to replenish the BA supply. As a result, concentrations of serum total and LDL cholesterol are reduced, while HDL cholesterol and triglycerides are generally unaffected [21].

3.2 Omega-3

Omega-3 fatty acids are presented in two formulas:

- Docosahexaenoic acid (DHA)

- Eicosapentaenoic acid (EPA)

Omega-3 fatty acids are important in reducing triglycerides and non-HDL cholesterol [22–24].

Reducing triglycerides and cholesterol helps to reduce atherosclerosis [25–28].

Using omega-3 fatty acids has benefits in metabolic abnormality associated with non-alcoholic fatty liver in patients with hyperlipidemia [29].

3.3 Garlic

Garlic (*Allium sativum*) belongs to onion genes. It used as an herb medication for various diseases. It has major roles in decreasing risk factors of cardiovascular diseases like high blood pressure and high serum lipids [30–33].

Plant name	Type	Effects on lipid profile
Dietary fiber	Food	Lowers LDL and cholesterol levels
Omega-3	Food	Lowers cholesterol and triglyceride levels
Garlic	Food	Lowers cholesterol and triglyceride levels
Red yeast rice	Food	Lowers cholesterol level
Chinese medicine	Herbal	Lowers hyperlipidemia
Artichoke	Food	Lowers cholesterol level
Fenugreek	Herbal	Lowers cholesterol level
Gum residue guggulipid	Herbal	Lowers LDL and cholesterol levels
Ginger	Food	Lowers cholesterol level

Table 1.
Foods and herbals and their effects on lipid profiles.

Name	Type	Effects on lipid profile
Vitamin B3 (niacin)	Water-soluble vitamin	Lowers LDL, cholesterol, and triglyceride levels
Vitamin B5	Water-soluble vitamin	Lowers LDL, cholesterol, and triglyceride levels
Vitamin C	Water-soluble vitamin	Protects against LDL oxidation
Vitamin D	Fat-soluble vitamin	Reduces the risk of arterial blockage
Magnesium	Mineral	Protects against LDL oxidation
Manganese	Mineral	Protects against LDL oxidation
Zinc	Mineral	Protects against dangerous lipoproteins and promotes HDL
Selenium	Mineral	Protects against dangerous lipoproteins
Copper	Mineral	Protects against dangerous lipoproteins
Coenzyme Q10	Mineral	Protects against dangerous lipoproteins
Chromium	Mineral	Increases HDL level
Choline	Mineral	Controls HDL level
Inositol	Mineral	Lowers LDL and triglyceride levels
Lipoic acid	Mineral	Lowers LDL and protects against cholesterol oxidation
Carnitine	Mineral	Lowers LDL and triglyceride levels

Table 2.
Vitamins and minerals and their effects on lipid profiles.

Garlic reduces cholesterol, LDL, and triglyceride levels by inhibiting cholesterol biosynthesis in the liver and LDL oxidation [34–38].

There are a few side effects associated with using garlic such as allergic dermatitis [39] and its interference with oral anticoagulant drugs [39].

3.4 Read yeast rice

Red yeast rice is a product of rice and is found in China and many Asian countries where it is used as a traditional medicine [40, 41].

Biochemically it contains polyketides, unsaturated fatty acids, phytosterols, pigments, and monacolins [41, 42]. It lowers cholesterol by inhibiting 5-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase, which is the rate-limiting step for cholesterol synthesis in the liver. This component, especially monacolins, is chemically similar to lovastatin (a drug used to treat hypercholesteremia) [41, 43].

3.5 Chinese medicine

Traditional Chinese medicine (TCM) has been used in clinical practice for many centuries. Chinese medicine has shown good effects for human health and treating many diseases. Recently, TCM has shown a beneficial effect for treating dyslipidemia; however, its mechanism remains unclear or totally unknown. Many studies on dyslipidemia with a single Chinese herb showed that TCM can improve phlegm, dampness, and blood stasis syndromes in patients with hyperlipidemia, therefore it has a beneficial effect for lowering hyperlipidemia monomers or effective extracts [44–46].

One study [46] showed that Chinese herbs, which have effects on hyperlipidemia, have four beneficial characteristics:

1. Clearing heat and removing toxicity, for example, Radix et Rhizoma Rhei, Rhizoma Polygoni Cuspidati, Semen Cassia, Coptis chinensis, Scutellaria baicalensis, Gynostemma pentaphyllum, and Radix Puerariae.

2. Promoting blood circulation and removing blood stasis, for example, Fructus crataegi, red yeast rice, Rhizoma, Radix *Salvia miltiorrhizae*, and Turmerone.

3. Eliminating dampness and phlegm, for example, Rhizoma Alismatis, plantain seed, and folium nelumbinis.

4. Increasing body energy, for example, Radix Astragali, Radix Ginseng, and Radix polygoni multiflori.

3.6 Artichoke

Another herbal remedy available for reducing high cholesterol levels is the leaf extract of *Cynara scolymus*, commonly known as artichoke thistle. *Cynara cardunculus* var. *scolymus*, or globe artichoke, is mainly cultivated as a food crop. It is a perennial plant that is largely native to the Mediterranean region in Southern Europe and Northern Africa, and the Canary Islands. In addition to food, artichoke is used in tea and liqueur preparation. Studies on the medicinal properties of artichoke have been continuing over the last six decades. Several in vitro and in vivo studies have investigated the effect of artichoke leaf extract (ALE), especially cymarine, in reducing plasma cholesterol levels [47–50]. Along with cymarine, the antiatherosclerotic effect of luteolin-rich artichoke extract reduces LDL oxidation in a dose-dependent manner [51]. A dose-dependent inhibition of cholesterol biosynthesis, using ALE, was also shown in primary-cultured rat hepatocytes [52].

In addition to in vitro and in vivo studies, randomized controlled studies have assessed the effects of the oral administration of ALE in hypercholesterolemic patients. Bundy et al. assessed the effect of ALE on plasma lipid levels and general well-being in healthy individuals with mild to moderate HC [53]. The participants of the study received 1280 mg of ALE daily (four tablets of 320 mg) for 12 weeks. The majority of participants were females, and almost 90% of them were more than 40 years old. The plasma cholesterol levels were found to be reduced by 4.2%

in the group administered ALE, whereas they increased by 1.9% in the placebo group. No significant difference in LDL cholesterol, HDL cholesterol, or triglycerides was observed between the groups. Englisch et al. conducted a similar study among 18–70-year-old hypercholesterolemic patients [54]. In addition to treatment with cholesterol-reducing drugs, participants were prohibited from antibiotic treatment. The intervention group received 1800 mg of ALE for 6 weeks. Total cholesterol levels were reduced by 18.5% in the group administered with ALE as compared to a 8.6% reduction in the placebo group. In addition to atherosclerosis, HC can affect organs such as kidneys. Studies in rats have shown that cholesterol can increase the incidence of glomerulosclerosis, and in vitro cell culture studies using human glomerular cells revealed the possible mechanisms that are involved in lipid-influenced glomerular damage [55]. Another study showed that treating HC in obese rats reduced their glomerular injuries [56]. Similar observations have also been made in studies with humans. Individuals with high triglycerides or a lecithin–cholesterol acyltransferase deficiency gradually developed renal failure due to glomerulosclerosis [57].

C. cardunculus leaf extract (CCL) not only has cholesterol-reducing capacity but also reduces blood glucose levels and repairs impaired kidney function and damage. These findings are significant particularly because HC results in further complications such as diabetes and kidney damage, both of which can be treated effectively with artichoke [50].

The hypercholesterolemic properties of artichoke involve inhibition of the enzyme HMG-CoA reductase. By lowering blood cholesterol levels and improving lipid profile, experts believe that artichoke can reduce the risks of arteriosclerosis and coronary heart disease and found that both CCL and *C. cardunculus* pulp extract.

decrease the concentration of the respective enzymes (an increase in levels of aspartate transaminase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP) are indicators of liver dysfunction), hence serving hepatoprotective and regenerating effects [58]. Thus, it was concluded that artichoke has a beneficial effect on cardiovascular and liver disease.

3.7 Fenugreek seeds

Fenugreek (*Trigonella foenumgraecum*) has an effect on cholesterol and blood sugar. It is a good source of dietary fiber and has beneficial effects on decreasing cholesterol levels in blood and the liver [59, 60].

The mechanism of the lipid-lowering effect of fenugreek seeds is due to the presence of 4-hydroxyisoleucine, a branched chain amino acid [61], and its action on adipocytes and liver cells, which leads to decreased triglycerides, cholesterol, and LDL [62, 63].

3.8 Gum residue guggulipid

A gum resin of the tree *Commiphora mukul*, used for the management of obesity and lipid disorders, is centuries old [64]. The extract of this gum resin, designated guggulipid, has lipid-lowering effects in normal and hyperlipidemic animals (rats, rabbits, and monkeys) [65, 66].

In humans, many studies of the effect of gum resin gumsome in response to guggul treatment were observed in of patients in India [67].

In the United States, studies showed that 18% of patients showed a response to guggulipid treatment, with a decrease in LDL levels of more than 5% [68].

Variations in the results of clinical studies are due to many factors such as ethnic and genetic backgrounds, dietary restraints, and lifestyle [69].

3.9 Ginger

Ginger (*Zingiber officinale*) is a traditional natural plant, which has many characteristics such as decreasing lipid levels, antiplatelet aggregation, and antioxidant and anticarcinogenic qualities [70]. Several studies show that ginger can lower high cholesterol levels in animals. In humans a few study results showed the effects of using ginger in patients with high cholesterol and in the treatment of dyslipidemia [71].

4. Vitamins and minerals

4.1 Vitamin B3 (niacin)

Niacin is a water-soluble vitamin. It effectively lowers the atherogenic lipoprotein(a) by decreasing the rate of synthesis in the liver and lowering the level of cholesterols as well as triglycerides [72, 73]. It is important in reducing the incidence of cardiovascular disease.

4.2 Vitamin B5

Vitamin B5 is a water-soluble vitamin, which is also called pantothenic acid. It is important in the synthesis of coenzyme A, as well as lowering LDL metabolism and reducing triglycerides [74, 75].

4.3 Vitamin C

Vitamin C is a water-soluble vitamin and is essential for repairing tissues and enzyme production. It has a role in lipid metabolism, protects LDL from oxidation, and lowers atherosclerosis and lipoprotein(a) in some people [76, 77].

4.4 Vitamin D

Vitamin D is a fat-soluble vitamin and has an important function in the body, including calcium homeostasis and suppressing foam cell formation, which reduces the risk of arterial blockage [78, 79] therefore reducing cardiovascular disease problems.

4.5 Magnesium

Magnesium protects LDL from being oxidized [80, 81].

4.6 Manganese

Manganese is a cofactor to the antioxidant superoxide dismutase that repairs damage to blood vessels caused by oxidized LDL [82, 83].

4.7 Zinc

Zinc protects against dangerous lipoproteins that lead to vascular inflammation and plaque formation. It also controls the gene that makes HDL [84, 85].

4.8 Selenium

Selenium prevents postprandial change in lipoproteins, which makes them easy to oxidize and become harmful [86, 87].

4.9 Copper

Many copper-dependent enzymes affect lipoprotein metabolism that build up fats and cholesterol in arteries [88–90].

4.10 Coenzyme Q10

Coenzyme Q10 lowers lipoprotein(a) and improves dyslipidemia medicine [91, 92].

4.11 Chromium

Chromium increases HDL levels and cooperates with niacin (B3) for dyslipidemia [93–95].

4.12 Choline

Choline controls HDL metabolism due to the enzyme lecithin cholesterol acyltransferase that has beneficial effects on lipoprotein metabolism [96, 97].

4.13 Inositol

Inositol lowers LDL levels, especially in patients with metabolic syndrome. It also lowers triglyceride levels [98–100].

4.14 Lipoic acid

Lipoic acid lowers LDL levels and protects against oxidized cholesterol [101, 102].

4.15 Carnitine

Carnitine lowers triglycerides, LDL, and the atherogenic lipoprotein(a) by transporting fatty acids into cells so that they can be used as energy [103–105].

5. Conclusion

Besides pharmacological treatments for HC, using alternative treatments may help to increase the effectiveness of drugs. Alternative treatments can help to alter sedentary lifestyles and include exercise, stopping smoking, and eating a number of foods (omega-3, garlic, red yeast rice), herbs (Chinese medicine), vitamins (B, B5, C, and D), and many minerals.

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